GUIDELINES FOR
SYNTHETIC TURF
BASE SYSTEMS

Synthetic Turf COUNCIL

STMA 29th Conference & Exhibition
Fort Worth, TX

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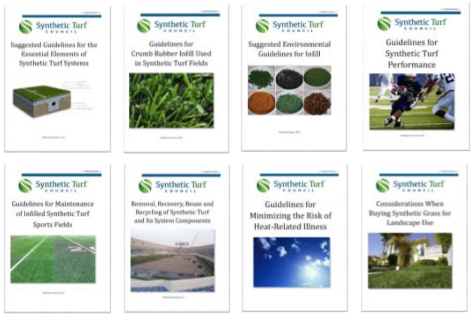
Synthetic Turf COUNCIL

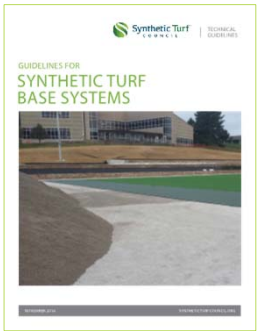
STC GUIDELINES – HOW DO THEY FIT IN THE STC'S MISSION STATEMENT AND STRATEGIC PRIORITIES

STC's Four Pillars of Strategic Priority

- **Advocacy**
- **EDUCATION**
- **Marketing**
- **Networking**

« STC promotes industry **excellence** through guidelines, certifications, and other learning platforms »





WHAT IS THE DOCUMENT'S TARGET AUDIENCE?

DESIGNERS

- Drawing a general overview of a design process that should help avoid costly mistakes.
- Educating those uninitiated who are called upon to assume design of turf projects.

BUILDERS

- Helping inexperienced builders develop a working knowledge of this quite unique endeavor.

OWNERS AND PROMOTERS

- Providing owners with some basic knowledge to help them monitor the work of those they entrust with their project.

WHAT ARE THE DOCUMENT'S OBJECTIVES?

CONTRIBUTING TO SYNTHETIC TURF PROJECTS' SUCCESS AND ENSURING THEIR:

- Performance
- Longevity and usability

PROVIDING AN OVERVIEW OF A DESIGN PROCESS APPLICABLE TO ANY PROJECT WHERE GRANULAR MATERIALS ARE USED IN A STRUCTURAL MANNER

- Beyond permeability, striving for stability is the common objective of any stone base.

WE WILL BE EXPLORING THREE (3) MAIN CHAPTERS

1. BACKGROUND
2. TERMINOLOGY
3. **FUNCTIONS AND COMPONENTS OF A STONE BASE SYSTEM**
4. **DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM**
5. **CONSTRUCTION AND INSTALLATION**

3. FUNCTIONS AND COMPONENTS OF A STONE BASE SYSTEM

3.1 FUNCTIONS OF A TYPICAL STONE BASE SYSTEM

"The base on which the synthetic turf is installed must provide a structurally sound foundation for the turf surface, as well as a medium for drainage of the surface."

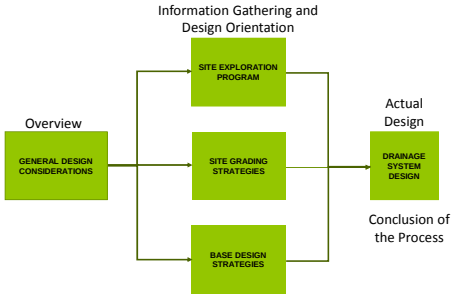
3.1.1. Structural Stability
3.1.2. Drainage
3.1.3. Storm Water Management and Flow Control

3. FUNCTIONS AND COMPONENTS OF A STONE BASE SYSTEM

3.2. COMPONENTS OF A TYPICAL STONE BASE SYSTEM

3.2.1. Native sub-grade soil
3.2.2. Base stone and finish stone
3.2.3. Stone/Soil Interface
3.2.4. Drainage Pipes
3.2.5. Peripheral Drainage Elements
3.2.6. Drainage and Shock Attenuation Pads

4. DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM



4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.1. GENERAL DESIGN CONSIDERATIONS

4.1.1 The synthetic turf stone base – the drainage/stability paradox

" Stability and drainage are set at opposite ends of the physical properties spectrum. "

Attaining the proper balance between the two opposing properties is the determining factor in the design of a stone base, its drainage strategy and its eventual construction.

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.1. GENERAL DESIGN CONSIDERATIONS

4.1.2 Drainage system performance

« The drainage system should be designed to meet the performance requirements of the local jurisdiction. Where no local regulations exist, the design storm frequency (and design of the entire drainage system) should be determined by a registered professional civil engineer. »

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.1. GENERAL DESIGN CONSIDERATIONS

4.1.3 Project Specific Drainage Considerations

- Local climatic conditions
- Subgrade soil type
- Site topography
- Retention/Detention requirements and associated strategy design

Geotechnical survey is critical

"Knowledge of the local soil conditions is very important to obtain a peak performing synthetic turf surface and to keep the drainage system's scale and associated costs within optimal limits."

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.1 GENERAL DESIGN CONSIDERATIONS

4.2 SITE EXPLORATION PROGRAM

"The design of a synthetic turf sports surface should be preceded by a thorough inventory and analysis of the site it is to be built on."

4.3 SITE GRADING STRATEGIES

4.4 BASE DESIGN STRATEGIES

4.5 DRAINAGE SYSTEM DESIGN

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.2 SITE EXPLORATION PROGRAM

4.2.1. Physical exploration strategy
4.2.2. Site geotechnical sampling program
4.2.3. Sub-Grade evaluation
4.2.4. Regional climatic considerations
4.2.5. Engineering guidelines

As information is collected, preliminary design options appear and orient the site exploration program

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.2 SITE EXPLORATION PROGRAM

4.2.1. Physical exploration strategy

4.2.1.1. Site's human and environmental history
4.2.1.2. Study of existing site conditions
4.2.1.3. Identify projected work types – Preliminary design
4.2.1.4. Site hydrology

4.2.2. Site geotechnical sampling program
4.2.3. Sub-Grade evaluation
4.2.4. Regional climatic considerations
4.2.5. Engineering guidelines

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DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.2 SITE EXPLORATION PROGRAM


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DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.2 SITE EXPLORATION PROGRAM

4.2.1. Physical exploration strategy
4.2.2. Site geotechnical sampling program
  4.2.2.1. Soil borings
  4.2.2.2. Soil tests and analysis
  4.2.2.2.1. Geotechnics
  4.2.2.2.2. Environmental aspect
4.2.3. Sub-Grade evaluation
4.2.4. Regional climatic considerations
4.2.5. Engineering guidelines

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DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.2 SITE EXPLORATION PROGRAM

4.2.1. Physical exploration strategy
4.2.2. Site geotechnical sampling program
4.2.3. Sub-Grade evaluation
  4.2.3.1. Load-bearing capacity
  4.2.3.2. Geotechnical properties of disturbed soils
  4.2.3.3. Organics, debris, contaminants
  4.2.3.4. Presence of rocks (in frost situations)
  4.2.3.5. Groundwater
4.2.4. Regional climatic considerations
4.2.5. Engineering guidelines

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.1 GENERAL DESIGN CONSIDERATIONS

4.2 SITE EXPLORATION PROGRAM

4.3 SITE GRADING STRATEGIES

"Surface grading is critical in the design of a synthetic turf surface."

4.4 BASE DESIGN STRATEGIES

4.5 DRAINAGE SYSTEM DESIGN

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.3 SITE GRADING STRATEGIES

4.3.1 Working through soil horizons

4.3.2 Balancing cut & fill

4.3.3 Surface shaping

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DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.3 SITE GRADING STRATEGIES

4.3.1 Working through soil horizons

4.3.2 Balancing cut & fill

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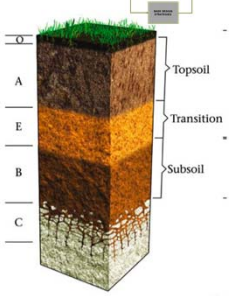

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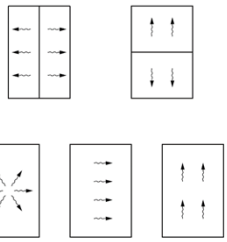
4.3 SITE GRADING STRATEGIES

4.3.2 Balancing cut & fill

4.3.3 Surface shaping

The most effective surface drainage strategy is the one that provides the shortest route out for the water running off the surface



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4.1 GENERAL DESIGN CONSIDERATIONS

4.2 SITE EXPLORATION PROGRAM

4.3 SITE GRADING STRATEGIES

4.4 BASE DESIGN STRATEGIES

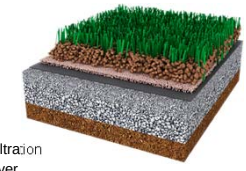
"The base must act as structural support for the synthetic turf surface … The base is also an integral component of the surface's drainage system. »

4.5 DRAINAGE SYSTEM DESIGN

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.4 BASE DESIGN STRATEGIES

4.4.1. The stone base complex



- Sub-grade
- Clean aggregate base layer
- Structural stone layer
- Stone dust grading layer
- Geo-fabrics – Soil separation / filtration
- Percolation through the stone layer
- Drainage in a structural drainage stone layer
- Drainage in a clean aggregate layer laid below the structural base
- The stone base as a support structure

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.4 BASE DESIGN STRATEGIES

4.4.1. The stone base complex

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.4 BASE DESIGN STRATEGIES

4.4.2. Field surface runoff

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.4 BASE DESIGN STRATEGIES

4.4.3. Drainage pipes and other accessories

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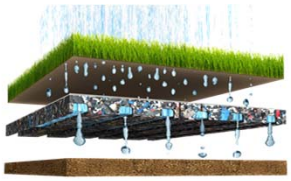
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.4 BASE DESIGN STRATEGIES

4.4.3. Drainage pipes and other accessories



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4.2 SITE EXPLORATION PROGRAM

4.3 SITE GRADING STRATEGIES

4.4 BASE DESIGN STRATEGIES

4.5 DRAINAGE SYSTEM DESIGN

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

"A turf drainage system encompasses the turf and infill, the base, the drainage water evacuation system and, ultimately, the municipality's rain sewer network stormwater/runoff collection points. In some instances, it can even be designed to contribute to the recharge of the water table.

4.5 DRAINAGE SYSTEM DESIGN

4.5.1. Drainage system design parameters
4.5.2. Storm water management
4.5.3. Drainage pipe network
4.5.4. Drainage pipe network sizing and layout
4.5.5. Sloping and grading
4.5.6 Open minded design approach

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.5 DRAINAGE SYSTEM DESIGN

4.5.1. Drainage system design parameters

4.5.1.1. The rainfall event

4.5.2. Storm water management
4.5.3. Drainage pipe network
4.5.4. Drainage pipe network sizing and layout
4.5.5. Sloping and grading
4.5.6 Open minded design approach

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DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

4.5 DRAINAGE SYSTEM DESIGN

4.5.1. Drainage system design parameters

4.5.2. Storm water management

4.5.2.1 Flow control and water retention/detention

4.5.3. Drainage pipe network
4.5.4. Drainage pipe network sizing and layout
4.5.5. Sloping and grading
4.5.6 Open minded design approach

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4.5 DRAINAGE SYSTEM DESIGN

4.5.1. Drainage system design parameters
4.5.2. Storm water management

4.5.3. Drainage pipe network

4.5.3.1. Lateral Drainage network
4.5.3.2. Collector drainage network

4.5.4. Drainage pipe network sizing and layout
4.5.5. Sloping and grading
4.5.6 Open minded design approach

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4.5 DRAINAGE SYSTEM DESIGN

4.5.1. Drainage system design parameters

4.5.2. Storm water management

4.5.3. Drainage pipe network

4.5.4. Drainage pipe network sizing and layout

4.5.4.1. Pipes in or below drainage layer

4.5.5. Sloping and grading

4.5.6 Open minded design approach

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4.5 DRAINAGE SYSTEM DESIGN

4.5.1. Drainage system design parameters

4.5.2. Storm water management

4.5.3. Drainage pipe network

4.5.4. Drainage pipe network sizing and layout

4.5.5. Sloping and grading

4.5.5.1. Sloping drainage surfaces

4.5.5.2. Sloping drainage pipes

4.5.6 Open minded design approach

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4.5 DRAINAGE SYSTEM DESIGN

4.5.1. Drainage system design parameters

4.5.2. Storm water management

4.5.3. Drainage pipe network

4.5. 4. Drainage pipe network sizing and layout

4.5.5. Sloping and grading

4.5.6 Open minded design approach"

"… it is important to approach this with a clear set of objectives and that the resultant design be specifically tailored to each individual project's specific site and regulatory constraints and its design objectives. "

4.
DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

BASE AND DRAINAGE SYSTEM DESIGN FAILURE

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DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

BASE AND DRAINAGE SYSTEM DESIGN FAILURE

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DESIGNING A SYNTHETIC TURF BASE AND DRAINAGE SYSTEM

BASE AND DRAINAGE SYSTEM DESIGN FAILURE
(On a 3 month old project)

5.
CONSTRUCTION AND INSTALLATION

5.1. EARTHWORK AKA EXCAVATION AND GRADING

5.2. DRAINAGE SYSTEM

5.3. STONE BASE

5.
CONSTRUCTION AND INSTALLATION

5.1. EARTHWORK AKA EXCAVATION AND GRADING

5.1.1. Sub-grade preparation

5.1.1.1. Leveling benchmark
5.1.1.2. Organics & other problematic soil conditions
5.1.1.3. Cut & fill – Stabilization
5.1.1.5. Proof rolling of sub-grade

5.1.2. Sub-grade tolerance

5.
CONSTRUCTION AND INSTALLATION

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5.1.1.2. Organics & other problematic soil conditions
5.1.1.3. Cut & fill – Stabilization
5.1.1.5. Proof rolling of sub-grade

5.1.2. Sub-grade tolerance

"The grade of the sub-base governs the flow of water from the field and stone layers into the lateral drains… The grade must be perfect and drain freely to the ditches that remove the water."

5.
CONSTRUCTION AND INSTALLATION

5.2. DRAINAGE SYSTEM

5.2.1. Drainage trench excavation

5.2.1.1. Bottom finish
5.2.1.2. Trench width and depth related to pipe sizing

5.2.2. Drain system

5.
CONSTRUCTION AND INSTALLATION

5.2. DRAINAGE SYSTEM

5.2.1. Drainage trench excavation

5.2.2. Drain system

5.2.2.1. Pipe grading and laying
5.2.2.2. Fill settlement
5.2.2.3. Manufactured connectors

5.
CONSTRUCTION AND INSTALLATION

5.3. STONE BASE

5.3.1. Stone handling and placement

5.3.2. Grading techniques and equipment

5.3.3. Grade tolerances and verification

5.3.4 Stone base testing

5.3.5. Stone base sign-off

5.
CONSTRUCTION AND INSTALLATION

5.3. STONE BASE

5.3.1. Stone handling and placement

- **5.3.1.1. Stone fragmentation and segregation due to improper handling and placement**
- **5.3.1.2. Compaction and over compaction**

5.3.2. Grading techniques and equipment

5.3.3. Grade tolerances and verification

5.3.4 Stone base testing

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CONSTRUCTION AND INSTALLATION

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CONSTRUCTION AND INSTALLATION

5.3. STONE BASE

5.3.1. Stone handling and placement

5.3.2. Grading techniques and equipment

- **5.3.2.1. Base protection**
- **5.3.2.2. Edge Grading**
- **5.3.2.3. The use of a stone dust mix for precision grading**
- **5.3.2.5. Grading methodology**

5.3.4 Stone base testing

5.3.5. Stone base sign-off

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CONSTRUCTION AND INSTALLATION

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Grading techniques and equipment

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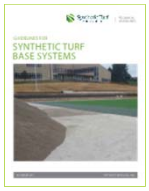

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